

# Science Toolkit: Grade k Objective 4.A.1.a

Standard 4.0 Chemistry

Topic A. Structure of Matter

Indicator 1. Compare the observable properties of a variety of objects and the materials they are made of using evidence from investigations.

Objective a. Examine and describe various objects in terms of the materials, such as clay, cloth, paper, etc. from which they are made.

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### Science Grade K Standard 4

A study of chemistry gives students opportunities to develop and /or verify ideas about the structure of matter, states of matter, interaction of matter, and conservation of matter. One of the most powerful developments in the history of science is the atomic/molecular model of matter, which can be used to explain and predict a large variety of phenomena. Students must slowly build their knowledge base before they are capable of explaining, or of understanding scientific theories that explain matter and its behavior in a variety of circumstances.

This begins in the early grades with multiple opportunities for students to observe and describe the properties of an array of diverse objects and the materials they are made of, to do something to these materials, such as mixing, heating, freezing, dissolving, and describe how they change. Students relate identified properties to their descriptions of what happens to both objects and materials and to their choice of appropriate materials for building different kinds of structures. They gradually recognize that properties of objects may differ from properties of the materials that they are made of. They should have lots of experience in constructing things from a few small parts, then taking them apart and rearranging them. They recognize that almost all objects, human-made and natural, are composed of parts and they begin to inspect things with magnifying tools to discover and describe features not visible without them.

In the intermediate grades, the study and use of materials continues and student collection and organization of data becomes more systematic and quantitative. At this grade band (3-5) and beyond students need many experiences with measuring, estimating and calculating sizes, capacities and masses of things around them. They learn that a lot of different materials can be made from a small number of materials and that all materials have distinctive physical properties such as, hardness, flexibility, and conduction of heat. They investigate what happens when materials are combined and compare the properties of the original materials with those of new material. Using appropriate tools they examine and describe the behavior of large collections of pieces, such as powders, sand, or marbles to consider that the collections may have properties that the pieces do not. They begin to construct an understanding of conservation by investigating that no matter how parts of a material are assembled; the mass of that material is always the same as the sum of its parts.

In middle school, the knowledge from previous grades is extended as students use evidence and explanations from several connected story lines to make sense of their investigations of matter. By the end of 8th Grade students should have a sufficient grasp of the general idea that a wide variety of phenomena can be explained by alternative arrangements of vast numbers of invisibly tiny moving parts called atoms. When students first begin to understand atoms, they cannot confidently make the distinction between atoms and molecules or make distinctions that depend upon it—among elements, mixtures, and compounds, or between "chemical" and "physical" changes. At this grade band students need multiple experiences studying substances to a) identify their distinguishing properties and recognize that most substances can exist as a solid, liquid or gas; b) recognize that some substances, the elements, do not break down during normal laboratory reactions and are the basic ingredients of all substances; c) to see a great many examples of reactions between substances that produce new substances with very different properties — some that result in physical changes, such as solutions and mixtures, and others that result in chemical changes, such as formation of compounds; and, d) understand that all substances,

living and non-living can be broken down to a set of about 100 elements. Students should now be able to use the notion of atoms as well as mass to explain that matter is conserved.